USE OF MULTIVARIATE ANALYSIS FOR DETECTING ORIENTATION CHANGES IN STEEL VIA LAUE DIFFRACTION ARTIFACTS WITHIN XRF SPECTRA

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Counterfeit and adulterated products and materials is a growing concern. We approach this problem via use of orthogonal set of materials characteristics and properties and utilize statistical models to test whether a material is genuine. The use of X-ray Fluorescence (XRF) in our suite of diagnostics has proven to be a useful tool in this regard. While XRF is employed for chemical composition, it may also yield important information regarding orientation effects via Laue artifacts in the XRF spectra. We have measured Stainless Steel witness samples originating from the same lot. One set was collected as-received and the second set was measured after mechanical rolling. Texture changes, which transpired during the rolling process, have been correlated to the changes in Laue artifact peaks present within the obtained spectra, and can be isolated as separate components via Multivariate Analysis (MVA). The isolation of Laue components serves as a means of identifying processing changes in the material, even though the chemical composition remains the same. We present resulting MVA-derived components of XRF spectra as well as compare-and-contrast these results with other measurements including X-ray diffraction and texture analysis, magnetic response, acoustic response, and other mechanical properties. These results demonstrate the use of XRF as a means of detecting materials changes, beyond strictly compositional results, which may serve as a signature for material alteration.

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